ALUMINUM

Project Fact Sheet

Recycling Aluminum Salt Cake

Benefits

- 94 percent energy savings relative to primary aluminum production by secondary aluminum smelters
- Preserved economic viability of the aluminum recycling industry
- Landfill avoidance: one million tons per year directly from salt cake recycling, 23.5 million tons per year due to preserving aluminum recycling
- Creation of a new U.S. salt cake treatment industry with new jobs

Applications

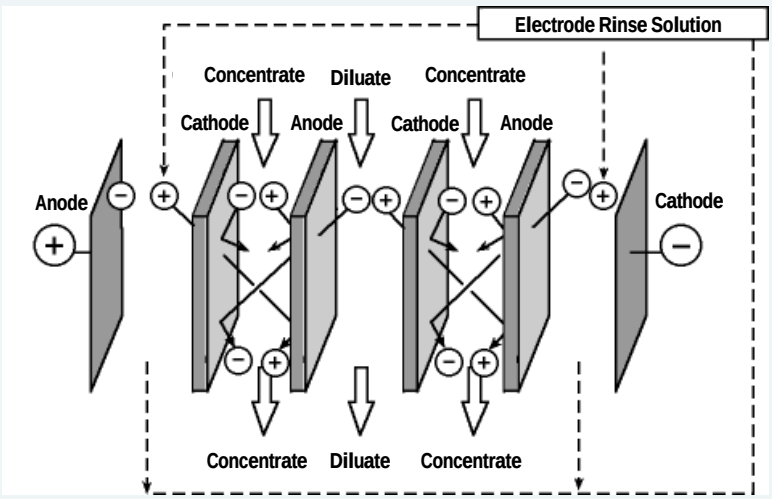
Through successful development, the *Recycling Aluminum Salt Cake* project promises to provide a cost-effective process to separate salt cake into its constituents and recycle the aluminum and salt fractions to the secondary aluminum smelters, as well as convert NMP to value-added alumina products.

Recovery and re-use of salt cake constituents will eliminate the need for landfill of aluminum processing wastes

Salt cake, a waste generated by the aluminum industry during the treatment of aluminum drosses and scrap, consists of entrained aluminum metal, spent salt fluxes, and residue oxides. Approximately one million tons of salt cake are landfilled annually. The leachable chloride content in landfilled salt cake presents potential environmental concern, and a commercially viable process for recycling salt cake in the U.S. does not currently exist. Thus, enhancing aluminum recycling technologies to minimize/eliminate landfilling of salt cake is a performance target set by the *Aluminum Industry Technology Roadmap.* In addition to creating a new U.S. industry, development of a cost-effective salt cake processing technology will protect the economic viability of aluminum recycling in general, since the growing use of aluminum is increasing the volume of salt cake landfilled annually.

The conventional method of salt cake recycling includes crushing and screening to recover the entrained aluminum, dissolving the soluble salts in water, recovering the salts by evaporation of the process brine, and filtering to recover the nonmetallic product (NMP). This method is energy-intensive and costly compared to disposal by landfill.

Schematic of Electrodialysis Process



Schematic of the electrodialysis (ED) process for concentration and recovery of salt from salt cake brine solutions.

Project Description

Goals: (1) Develop a cost-effective process to separate salt cake into its constituents and recycle the aluminum and salt fractions to the secondary aluminum smelters, and (2) convert NMP to value-added alumina products.

Salt cake recovery is the most energy- and cost-intensive unit operation in the recovery of salt cake constituents. Argonne National Laboratory (ANL) is developing a salt recovery process based on electrodialysis. Laboratory scale experiments and economic analysis have indicated that, for conditions consistent with salt cake recycling, the ED technology is more cost-effective for salt recovery than alternative technologies (e.g. evaporation with vapor recompression).

Increasing the market value of NMP is critical for cost-effective salt cake recycling. Impurities constitute approximately 10 percent of NMP and lower its market value. Research is being conducted to investigate hydrometallurgical processes to purify NMP, since higher NMP purity results in higher market value for refractory aggregate and other potential alumina markets. Markets which will require lower development costs, such as alternative aluminum units for the blast furnace in ironmaking, are also being explored.

Progress and Milestones

- Four processes for recycling salt cake and dross were investigated. Technical and economic analysis indicated the electrodialysis process to be most promising.
- Pilot-scale work indicated fiber insulation materials can be made cost-effectively using NMP as a starting material.
- A new potential use for NMP (i.e., as an alternative alumina source for ironmaking) has been identified.
- Process flow sheet and engineering design for pilot scale testing of the electrodialysis process have been completed.

Commercialization Plan

- Alumitech, Inc. has commercialized technology to convert NMP to fiber insulation.
- Blast furnace trials of NMP as an alumina source for ironmaking will be conducted in 1999.
- Pilot-scale demonstration of an electrodialysis process for recovering salt fluxes from salt slags will begin in 1999.
- Commercial demonstration of the electrodialysis process will begin in 2001.

Project Partners

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